STRATEGY RESEARCH PROJECT

RIDING THE TIGER: EXPLOITING THE REVOLUTION IN MILITARY AFFAIRS TO TRANSFORM THE BATTLEFIELD

 BY

LIEUTENANT COLONEL THOMAS A. DEMPSEY
United States Army

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Lieutenant Colonel Thomas A. Dempsey
United States Army

Colonel John Bonin
Project Advisor

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013

ABSTRACT

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Technological change in the Information Age will bring fundamental changes to how land warfare is conducted. The ongoing Revolution in Military Affairs will require fundamental revisions of warfighting doctrine, and supporting tactics, techniques and procedures. To fully harness the benefits of technological change, military institutions must transform warfighting methodology to optimize digital and automated systems. At the same time, doctrine and tactics must be modified to accomodate a far more lethal combat environment. The technology exists today to begin this process of transformation through the use of constructive and virtual simulations, supported by live experimentation with evolving digital systems.

Introduction

February Twenty-third, 2010: the commander of the Iraqi Republican Guard Armored Corps stood outside his command post, watching the storm. The Magdoob, that mix of blowing sand and rain peculiar to the southern deserts of Iraq, was finally abating. The General nodded in grim satisfaction. The storm had served its purpose, cloaking the redeployment of Iraq's premier military formation into its attack positions in Wadi Al-Batin. His forces had crossed the line of departure some three hours before. The General nodded again to himself, confident in the weapon that he had helped to organize, equip and train. His corps was ready for the Americans and their "Airland Battle".

Some eighty miles to the South, Brigadier General Mitchell was finishing his final "digitized rock drill" prior to commiting his digitized BrigadeTask Force to battle. He silently thanked God for Phoenix and the All Source Analysis System. Without the enhanced situational awareness provided by digital C4I (Command, Control, Communications, Computers and Information), the CINC would never have figured out what the Iraqis were doing in time. As it was, the only force the JTF could deploy within the short window of warning was Mitchell's digitized brigade. One brigade against an entire heavy corps. Well, he thought, now we'll find out just how much of an edge the technology gives us.

"OK, guys, let's review the plan one last time. You can see his formations moving out already." The screen was dominated by columns of red icons, strung out for more than a hundred kilometers. To the south, the elements of the digitized brigade could be seen as clusters of blue symbols. They were dispersed on either side of the Iraqi axis of advance, which was clearly identifiable thanks to the Iraqi reconnaisance patrols moving in advance of the corps.

"You can see that our brigade is deployed across twenty kilometers of frontage, about a hundred kilometers in depth. The key here is to wait until the

entire enemy corps is strung out within our brigade battle space, then hit him simultaneously, in depth, in a decisive attack on every major formation in the enemy corps. A tall order, but we have the horses to do it and now's the time to earn our pay.

"Our three armor battalions are deployed deepest in sector, and those battalions will have the mission of killing the lead division. You know my intent: hit his tank battalions from the flanks and rear, in a running battle, exploiting your ability to shoot-on-the-move and the digital capabilities of your Enhanced M1A2's. Take out his command tanks early, and don't let him mass for a head-to-head slugfest." Mitchell was uncomfortable using direct fires as the primary killer for this part of the fight, but he just didn't have enough indirect fire assets or PGM to go around.

"Jim, your Bradley battalion is positioned to tag his mech division for the Fires Task Force. Remember, you're a looker, not a shooter. I've got two full battalions of Crusaders and the ATACMS ready to bury that division in Brilliant Anti-Tank Munitions once you provide the sensor-to-shooter links. Your dismounted infantry should be pretty much indetectable, as long as they remember their thermal camoflage techniques and don't try to be heroes.

"No Mercy Six" (Lord, what a call sign; aviators!) "you've got the trail armored division. Make sure your Commanches have coverage of the entire division column before you engage; I want that division commander up to his ears in Apache Hellfires before he even realizes he's under attack. No Mercy Five, are you on?"

The Apache Battalion XO appeared momentarily in the upper corner of Mitchell's screen. "Yes sir, right here." He looked nervous. Well, no wonder, with the mission he had.

"Five, you've got the artillery brigade. And you had better get all of it, or we've got problems. The new Commanches should be good for six hours in a contaminated environment, even with the dusty mustard. Just make damn sure that when those Strike Eagles roll in, you've got every one of those guns targeted for them."

"Sir, we tested the data links with the F-15E squadron on the range last week. We're wired." The XO sounded confident enough now.

"OK, last but sure as hell not least, JSOTF are you on?" Mitchell hoped the remote link from King Khalid Military City was still working.

"Roger," the special forces colonel confirmed. "Our teams have the Scud launchers under surveillance and have linked up with the ANGLICO."

"The Surface Action Group will be online at 0130 local. Make sure your data feed to the SAG is established not later than 0145." Improved Tomahawk TLAM-C's were Mitchell's answer to Scud-busting. Sensor-to-shooter links would be provided by the Air Naval Gunfire Liaison Company personnel that had just linked up with the SF teams. The idea had better work.

Three hours later, a tank commander in the advanced guard of the leading Iraqi armored division sat in the turret of his T-90 tank, listening to the confused reports on the radio. They were taking losses, but didn't know from what. Perhaps mines, left over from the Gulf War? No matter, it couldn't be significant. He keyed his mike to report his position just as the 120 millimeter depleted uranium round impacted the rear of his tank, driving entirely through the engine and crew compartment. The commander did not survive the resulting catastrophic kill, as his tank joined more that two hundred burning hulks in what had been Iraq's best armored formation.

Simultaneously with the initiation of the attack on the lead division, teams of dismounted infantry began illuminating targets throughout the length of the

Iraqi mechanized division. Using the millimeter wave radar-based "point and shoot" target designators, the Bradley battalion infantry teams "tagged" twenty-four independent targets. The infantrymen had worked extensively with the Crusaders. They knew exactly what target to designate in each column in order to get the maximum number of armored vehicles in the Brilliant Anti-Tank (BAT) Munition footprint. Each team had an established data link to a two-gun Crusader section. The commander of the Fires Task Force nodded to his Operations Officer. Forty-eight Crusaders simultaneously engaged targets throughout the divisional march column. A rain of deadly BAT submunitions enveloped the Iraqi division in a storm of destruction. Within five minutes, the Iraqi formations had been reduced to wreckage. The Bradleys moved out of their hide positions, picked up their infantry teams, and began moving through the kill zone, rounding up prisoners and destroying what little organized resistance remained.

As their comrades to the south engaged the lead two Iraqi divisions, No Mercy Six sent an order to his scouts. Six Commanches rose simultaneously to expose their radar masts and paint the formations of the last Iraqi armored division. Within seconds, the carefully positioned scouts had illuminated the entire column, and each Commanche began passing targets to Apaches, rotor-down some ten kilometers to the south and west. Finally satisfied that most of the targeting was complete, No Mercy Six spoke a brief order on his command net. Eighteen Apaches began ripple-launching terminal homing millimeter-wave guided Hellfire missiles. More than 250 armored vehicles disappeared in blazing catastrophic kills in the space of less than a minute. No Mercy Six stared in awe at what was left of the enemy division. "OK, move in carefully and use the guns to finish off what's left. Get the air assault infantry company in here to start policing up POW's."

A few kilometers to the north, No Mercy Five had been tracking the artillery brigade with his six modified Commanches. As he listened to the traffic from the other fights, he watched the Iraqi artillery formations beginning to deploy off the road. A voice crackled in his ears: "No Mercy Five, this is Talon Lead inbound with six flights of two."

"Roger Talon Lead, we have your targets. Transmitting now." The data normally transmitted to Apache Longbows was now being sent to twelve F15E Strike Eagles, specially modified to translate the Commanche targeting data into forms usable by the Eagles' systems. As the first pair of aircraft popped up and rolled in on final, the lead Commanche's targets appeared on the Strike Eagle pilots' heads up displays. Each aircraft released twelve independently targeted, terminal homing PGM based on the Commanche sensor-to-shooter link. Within the space of a minute, the Strike Eagle squadron delivered 144 PGM, with devastating effects. As palls of black smoke enveloped the Iraqi artillery battalions, No Mercy Five and his Commanche scouts moved across the battlefield, searching out and destroying those artillery pieces missed by the air strike.

Within a few kilometers of the dying artillery brigade, Iraqi soldiers struggled frantically to perpare four Scud missiles for launch. Watching them from a low rise some distance away was the commander of the Special Forces Team, with the Marine ANGLICO Naval Gunfire Observer at his side. The Special Forces commander turned to the Marine. "The Tomahawks?"

"One minute out," the Marine responded, laconically.

"OK, light 'em up." The Marine sent a brief signal to his four teams of observers, and each observer illuminated one of the launchers with a millimeter-wave radar-based sensor similar to the one employed by the infantrymen of the Bradley battalion to the south. The observers then transmitted the data to the

improved TLAM-C's, which had been modified to accept in-flight targeting data. The Team continued to observe the launchers. The Tomahawks were invisible in the darkness, their arrival evident only from the near-simultaneous explosions that destroyed the four Scuds.

In the Brigade command post, General Mitchell regarded the Phoenix display in stunned silence. "Twenty minutes," he said softly. "Twenty minutes, and a whole enemy corps is gone. Hell, we could have used nukes and not done this much damage. OK, lets start cleaning up the battlefield and get recocked. I'll be on the horn to the CINC."

The preceding vignette, while fictional, is based on capabilities being developed and fielded as part of the U.S. Army Force XXI modernization program. During operational testing of the Apache Longbow in the spring of 1995, for example, Apache Longbows achieved a better than 92 per cent probability of hit on moving and stationary tactical vehicles in a realistic combat environment.[1] In August of the same year, the Focused Dispatch Advanced Warfighting Exercise (AWE) demonstrated the feasability of using digitized M1A2 tanks and M2A3 Bradleys to establish sensor-to-shooter links for the digitized Enhanced Mortar Fire Control System (EMFCS) and the Paladin digitized artillery system.[2]

The results of field trials like Focused Dispatch and the Apache Longbow Initial Operational Test and Evaluation (IOTE) provide convincing evidence that the Information Age will bring fundamental changes to how land warfare is conducted. The American Joint Staff, under the direction of Chairman of the Joint Chiefs of Staff John Shalikashvili, has articulated well the challenges-- and the opportunities-- that accompany the Information Age:

> This will be an era of accelerating technological change. Critical advances will have potentially enormous impact on all military forces. Successful adaptation of new and improved technologies may provide great increases in specific capabilities. Conversely, failure to understand and adapt could lead today's militaries into premature obsolescence and greatly increase the risks that such forces will be incapable of effective operations against forces leveraged by high technology.[3]

The implications of the Joint Staff's vision are inescapable: the world is in the midst of a far-reaching revolution in military affairs (RMA), one that will require fundamental revisions of war fighting doctrine and supporting tactics, techniques and procedures. To fully harness the benefits of rapid technological change, military institutions must transform warfighting methodology to optimize digital and automated systems. At the same time, doctrine and tactics must be modified to accomodate a far more lethal combat environment. The technology exists today to begin this process of transformation through use of constructive and virtual simulations, supported by live experimentation with evolving digital systems.

The Revolution in Military Affairs

The world is in the midst of a far-reaching Revolution in Military Affairs which will render current, industrial age warfighting methods largely obsolete. This RMA is characterized by increased range and lethality of weapons systems, enhanced situational awareness for digitally linked forces, and improved battle command using automated command and control processes. The cumulative effect of the RMA will be to render current industrial age warfighting methods largely obsolete. Exploiting the potential of the RMA will require re-engineering the "system of systems" that generates combat power on the battlefield. Doctrine, organization, tactics and battle command must be redesigned to

optimize performance of the information age systems that will enter the force in the coming years.

Increased battlefield lethality is a function of three interrelated trends: improved area indirect fire effects, proliferation of precision guided munitions (PGM) and enhanced sensor-to-shooter links. These three trends are all mutually reinforcing, creating a synergistic effect on the calculus of combat.

Enhanced lethality of area indirect fires represents the most significant of the three trends contributing to enhanced battlefield lethality. The fire support "battlefield operating system" is being transformed by a variety of technical innovations. Second and third generation Dual Purpose Improved Conventional Munitions (DPICM) provide a genuine area kill capability against light armored vehicles. These munitions are giving way now to area munitions with simple self-contained guidance systems which home on any armored vehicle in the "footprint" of the parent munition, and use a top-attack profile to defeat even heavily armored targets.[4] The most recent innovation in munitions may be the most significant: development of a position locator incorporated directly into the artillery or rocket round.[5] This will allow precise adjustment of artillery impacts, with unprecedented concentrations of highly accurate fire as a result.

Contributing to the rising lethality of munitions and submunitions are improvements in the tube and rocket artillery systems themselves. Integrated, on board Global Positioning Systems (GPS), fully automated targeting and fire control and much higher rates of fire are characteristics of the new systems. The M109A6 Paladin and the Enhanced Mortar Fire Control System (EMFCS) represent the leading edge of these innovations.[6] The trend will continue with the fielding of Crusader, a second generation, fully automated field artillery system with designed-in digital capability.[7]

The increased density of much more lethal indirect fires on the future battlefield represents a watershed in what has traditionally been called "indirect fire support." Artillery in the future will be able to achieve area kills on virtually every target on the battlefield, including the latest generation of main battle tanks. Simply stated, artillery has ceased to be a "support" weapon, and is fast becoming a primary killer in its own right. Field artillery units "fighting with fires" have the potential to join infantry, aviation and armor forces as a primary component of the maneuver battlefield operating system.[8] The ability of these units to concentrate their fires nearly simultaneously at any point within the commander's battlespace will place stationary, concentrated enemy forces at risk, no matter how well armored or dug-in they are.

The revolution in PGM is the second component of enhanced battlefield lethality. The proliferation of ground-, air- and sea-launched PGM is a hallmark of the RMA. These weapons enable lethal engagement of individual targets throughout the depth of the battlespace. The top-attack profile that is characteristic of these systems (Javelin, EFOGM and Hellfire II, for example) provides overmatch of all existing armor systems, and will continue to do so for the forseeable future. The systems are also characterized by increasing engagement ranges, significantly so in the case of the Apache Longbow-launched Hellfire.[9] Many of these PGM-based systems will be able to deliver concentrated fires of devastating lethality without the requirement of physically massing on the battlefield.

The third component of enhanced battlefield lethality, and a key enabler of the first two, is the revolution in sensor-to-shooter links. A precurser to this revolution, in primitive form, was an artillery forward observer in Operation Desert Storm using a GPS and a hand-held laser range finder to control artillery fires. This observer was able to determine his own location and the location of his

target with a degree of accuracy unheard of just a few short years before. The result was immediately responsive, effective indirect fires.[10] Advances in this area have accelerated sharply since Desert Storm. Development of the Soldier Integrated Protective Ensemble (SIPE) by Natick RD&E Center gives the individual infantry soldier the potential ability to establish fully digitized sensor-to-shooter links for systems as diverse as the Paladin and the PGM-armed A10 Thunderbolt. The potential for fully digitizing the individual combat infantryman is being fully explored in the Land Warrior program at Fort Benning.[11] Unmanned Aerial Vehicles, M1A2 digitized Abrams tanks, and M2A3 digitized Bradley fighting vehicles are all being developed as platforms for effective, digitized real-time sensor-to-shooter links.

The flagship of the U.S. Army effort to provide sensor-to-shooter links is the AH-64D Apache Longbow. Based on data continuously updated by its onboard millimeter-wave radar, a single AH-64D can control targeting for multiple Longbow-equipped aircraft, in much the same way that an AWACS provides targeting data and fire control for F-15 fighters in air-to-air combat. The other Apaches do not need line of sight to the target, and can ripple launch their terminal homing, fire-and-forget missiles based on the data from the single controlling aircraft.[12] Once the Longbow systems are interfaced successfully with digital field artillery fire control systems and similar Air Force systems, the Apache and its companion system, the Comanche, will be able to provide responsive sensor-to-shooter links for an entire family of weapons systems and munitions. This type of fully automated, digitally linked sensor platform has the potential to translate enhanced indirect fire effects and PGM strikes into the most lethal concentration of firepower the battlefield has ever seen.

Dramatic increases in range, concentration and lethality of fires will transform the calculus of land combat. That transformation will be accelerated by

developments in two other areas: enhanced situational awareness and automated C4I processes.

> The digitized brigade will develop a shared situational awareness resulting from common, up-to-date, near-complete friendly and enemy information distributed among all of its elements. The digitized brigade will locate enemy forces rapidly and precisely, whether those enemies are agrarian warlords, industrial armies, or an information age, digitized peer . . . The digitized brigade will know where its own forces are much more accurately than before, while simultaneously denying the same information to the enemy.[13]

This passage, from the Army's first "How to Fight" manual on digitized warfare, captures the essence of the digital revolution. Enhanced situational awareness encompasses a host of capabilities. Flowing from the top down, so to speak, a family of systems collects information from all sources across the battlespace, from national to tactical level, processes that information and makes it available and easily accessable to all levels of command down to brigade and eventually battalion. These systems include, among others, the Phoenix Command and Control system, the Advanced Field Artillery Tactical Data System (AFATDS), the All Source Analysis System (ASAS), and the Terrain Evaluation Model supporting the Obstacle Planning System (TEM/OPS).[14]

Digital combat and combat support systems compliment the "top down" systems in providing enhanced situational awareness. In addition to providing sensor-to-shooter links, systems like the M1A2 tank, the AH-64 Longbow Apache, and the Land Warrior provide a continuous digital flow of detailed, real-time, information. This data further enhances situational awareness at higher levels, and across the organization laterally. In combination, the flow of digital information vertically and horizontally in a digitized force builds a common picture

of the situation that is real time, and accurate to a degree unprecedented on the Industrial Age battlefield.

Automated C4I combines synergistically with enhanced situational awareness and is the final technical component of the RMA. Automation throughout the C4I infrastructure is producing dramatic improvements in the battle command process as a whole. The most comprehensive picture of this improvement was provided in May of 1995, during the Prairie Warrior '95 Advanced Warfighting Experiment, at Fort Leavenworth, Kansas. The Initial Impressions Report from the exercise observed the following:

> The quality of the command and control process outcomes improved dramatically with the integration of the Phoenix, the All-Source Analysis System (ASAS), the Advanced Field Artillery Tactical Data System (AFATDS) and the Terrain Evaluation Model supporting the Obstacle Planning System (TEM/OPS). . . . Automation of planning aides and techniques permitted rapid planning of multiple options, and supported accelerated speed of execution and improved integration of . . . combat power. The resulting improvements in the command and control process enabled the commander to get inside, and stay inside, of the enemy's decision process.[15]

Prediction is always fraught with uncertainty, but the salient characteristics of the RMA point to some fundamental changes in the dynamics of land combat. Unprecedented concentrations of lethal fires can be expected to inflict heavy losses among forces that mass on the future battlefield. Positional warfare as traditionally practiced will expose fixed, easily targeted units to immensely destructive combat effects. With the extension of these effects throughout the breadth and depth of battlespace, linearity will gradually disappear from the fight. Battlefield architectures based on the "close, deep, rear" paradigm will succumb to highly lethal fire strikes capable of being delivered anywhere, any time.

Traditionally organized and handled formations will move and react far too slowly on this battlefield, rendering the formations even more vulnerable to concentrated, lethal fires.

Proliferation of fully automated, digitally linked systems throughout this future battlefield will accelerate optempo by orders of magnitude. Automated command and control processes can potentially allow digitized forces to fully exploit the advantages of digital technology. These forces may be able to generate combat power faster, and with greater precision than organizations that continue to rely on Industrial Age technologies and warfighting techniques.

Those military institutions that fail to accomodate the changes being wrought by the RMA may find themselves, as the Joint Staff's Joint Vision 2010 cautions, "incapable of effective operations against forces leveraged by high technology."[16] However, transforming doctrine, organization and tactics is a difficult undertaking at best. This is especially true when the rapid pace of technological change generates requirements to adjust doctrine and tactics without the benefit of fully fielded digital systems. The armies that fought the Second World War had almost two decades to experiment with the tanks, aircraft armored artillery and trucks of the new mechanized battlefield. Military institutions today may have only months to transition to the digitized battlefield, in the event of a sudden threat driving the accelerated fielding of prototype systems. The institutions that will benefit most from the digital revolution are those that begin learning now how to integrate and exploit the capabilities of a fully mature digitized force. The fact that some of that force's equipment has not yet been fielded, or has been fielded in very primitive form, should not deter warfighters from attempting to master the art of war in the Information Age.

Fortunately, the same wave of technological change that is causing reevaluation of warfighting doctrine, offers new tools with which to undertake that reevaluation. Modern constructive and virtual simulations provide a warfighting venue of unprecedented realism for doctrinal experimentation and training development. Many of these simulations can replicate operations of a fully mature digitized force on future battlefields. This permits warfighters to experience the increased lethality, enhanced situational awareness and automated C4I processes that will characterize combat operations in the Information Age. When the lessons from these simulations are harnessed in realistic field trials with prototype digital equipment, as they were last summer in Focused Dispatch, valuable lessons can be learned about how to plan, organize and fight on the battlefield of the future.

Virtual Kyrgyzstan: Fighting Tomorrow's War Today

> What we require today is . . . another Experimental Brigade, in which not only new weapons of war will be tried out and new tactics elaborated, but new methods of discipline will be tested; for though the heart of man does not change, or so slightly as to be imperceptible, his intelligence must expand as war becomes more scientific, and, consequently, the discipline of his mind must change with his tactics.[17]

It has been almost eighty years since J. F. C. Fuller issued the clarion call for change quoted, in part, above. The U.S. Army's own "Experimental Brigade" is in the process of organizing today at Fort Hood, Texas, as part of the Army Experimental Force (EXFOR) in the 4th Infantry Division. Developing doctinal concepts for the EXFOR has become a top priority at the U.S. Army Armor Center. Doctrinal development was initially hampered by the limited amount of digitized equipment available for testing at Fort Knox. Digital doctrine writers at Fort Knox have focused on use of simulations to overcome this limitation.

Over a period of eight months in 1994 and 1995, the Advanced Warfighting Working Group (AWWG) at the Fort Knox Armor Center conducted a series of Advanced Warfighting Exercises that became known as "Virtual Kyrgyzstan." The Exercises used constructive simulation to test concepts under development for the mounted digitized brigade. Initial "brainstorming" among Mounted Warfare doctrine writers suggested that entirely new tactics, organizations and warfighting techniques would be required to fully exploit the advantages of digitized warfare. The group had many ideas about what the concepts central to digital operations should be, but had very little real experience to build on. Constructive simulations offered a means to experiment with radically different ways of fighting the companies, battalions and brigades of the mounted force. The Janus simulation was determined to be especially suited to the Group's needs.

Janus is a constructive simulation that models combat at the tactical level with the full range of combat capabilities and weapons systems. All battlefield operating systems are modeled, and each workstation can control elements as small as platoons or as large as a battalion task force. The system is currently used to teach tactics to battalion and brigade commanders at the Army Tactical Commander's Development Course at Fort Leavenworth, Kansas, and is used at Fort Knox to instruct Armor Officer Advanced Course students in company- and battalion-level operations.

Janus provides an unprecedented level of tactical resolution. The accuracy with which the system models direct and indirect fire exchanges, movement, visibility and target acquisition (to include weather and light data) supports detailed analysis of complex tactical engagements. The system can also replicate the benefits of fully mature digitized combat systems and automated C4I within a future digitized force.

Using Janus, company commanders can observe the precise locations and activities of their assigned forces, as well as the forces of adjacent friendly units. They can also see on their work station screens those enemy units which their subordinate elements are observing and engaging. With carefully limited use of a "controller" station, with one hundred per cent of friendly and enemy information, battalion and brigade commanders and staff can benefit from the detailed information that Phoenix, ASAS and similar systems will make available to the digitized force.

During the exercises, the use of the Janus simulation enabled company, battalion and brigade commanders and staff to enjoy the enhanced situational awareness which will be available to a digitized force once fully mature digitized technology has been fielded. The unique characteristics of the Janus work stations also replicated many of the automated C4I processes associated with Phoenix, ASAS and TEM/OPS. The experiments employed a classified version of Janus to simulate advanced (circa 2004) friendly and enemy systems, generating the increased lethality that we expect to encounter on the Information Age battlefield.

The AWWG conducted a series of five exercise "runs" using Janus. The intial "run" employed current doctrine and forces to establish a baseline against which to measure performance of the digitized brigade in the advanced scenarios. In the baseline scenario, executed in conjunction with the 194th Separate Armored Brigade, a Blue (friendly) M1/M2 equipped battalion task force defended against a Red (enemy) motorized rifle regiment (MRR) equipped with BMP's and T-72 tanks. The outcomes of this and similar scenarios usually resulted in defeat of the Red MRR, but with most of the Blue maneuver companies combat ineffective by the end of the fight.

In designing the next two digital scenarios, the AWWG used a significantly more capable Red "force package" while keeping the Blue force constant at roughly one heavy battalion equivalent. In the final digital AWE, directed by then-Brigadier General Lon Maggart, the Armor Center Assistant Commandant, a Blue digitized brigade conducted an attack on a Red motorized rifle division. The AWE's were conducted on a variety of terrain types, including desert (the National Training Center at Fort Irwin, California) and heavily wooded and built up areas of Central Europe.

In designing experimental doctrine and tactics for the experiment, the AWWG built upon concepts articulated in TRADOC Pamphlet 525-5, Force XXI Operations.[18] Blue force plans and operations emphasized depth, simultaneity, decisive attack, internetted non-hierarchical command techniques, and asymmetrical engagement on a non-linear battlefield. Planners dispensed with traditional control measures (unit boundaries, battle positions, directions of attack, etc.) in order to provide maximum flexibility to subordinate leaders, and because such measures are not expected to be necessary for a fully digitized force.

The results of the exercises were striking. In the initial digitized scenario, a Blue heavy battalion, reinforced with a heavy cavalry troop and an air assault company/team, fought two MRR's supported by two artillery groups. The Blue battalion task force successfully executed a simultaneous attack on all four elements of the attacking force. It destroyed the leading MRR and the two artillery groups, and defeated the second MRR by preventing its penetration through Blue battlespace. Roughly half of the Blue maneuver companies remained combat effective at the end of the fight.

In the second digitized scenario, a similarly structured Blue force opposed a full strength Red tank regiment supported by a regimental and a division artillery group. Two Red motorized rifle battalions were played as adjacent forces

advancing on the flanks of the tank regiment. The Blue task force was again successful in executing a simultaneous decisive attack throughout the depth of the Red column. At the close of the battle, the tank regiment and both of the adjacent BMP battalions had been entirely destroyed, as had both artillery groups. Of possibly even greater significance than the devastating effects achieved on the Red force, all Blue ground maneuver company/teams remained combat effective at the end of the fight. The loss exchange data for this scenario was remarkable: although the Red force enjoyed a 2.5 to 1 superiority in main battle tanks, the main battle tank loss exchange rate was 4.6 to 1 in favor of Blue. Red had a 4.7 to 1 advantage in infantry fighting vehicles, but the IFV loss exchange rate was 4.1 to 1 in favor of Blue. With a 3.8 to 1 advantage in artillery, Red was on the losing end of a devastating 9.4 to 1 loss exchange rate for artillery systems. It appeared that, in the context of a constructive simulation, the digitized force was achieving significant synergistic effects.[19]

The final AWWG exercise was the most ambitious. The Red force was a full division, defending with partially prepared positions in an area of Central Europe characterized by close terrain generally thought to favor defensive operations. While the three MRR's of the division were at thirty-five to forty per cent strength, the divisional tank regiment was at ninety per cent strength, the divisional artillery was at almost full strength, and the division was supported by an army artillery group and a rocket artillery group. Supporting forces included Red fixed-wing air, an air mechanized battalion with lift, and an attack helicopter regiment. The Red force was opposed by a digitized Blue brigade of two tank battalions, one mechanized battalion, and an air assault battalion task force.

The attack of the digitized brigade was an overwhelming success. Its subordinate elements used their enhanced situational awareness to penetrate the MRD defenses in small groups, positioning throughout the depth of the enemy

defense. Once all forces were in position, the Brigade Commander (General Maggart) initiated a simultaneous attack on all elements of the MRD defense, achieving complete surprise and destroying the tank regiment, the artillery groups, and the air mechanized forces. Corridors were established through the defending MRR's to support exploitation by follow-on Blue forces. Two of the three ground maneuver battlions remained combat effective at the end of the battle. The loss exchange data was not as favorable as it had been in the previous exercise. On the other hand, current doctrine would have commited an entire heavy corps to an attack of this sort, which normally requires a 6 to 1 superiority in combat power for a reasonable prospect of success. The digitized brigade had achieved the combat effects of an Industrial Age formation an order of magnitude larger in size.[20]

The results of the digitized scenarios all supported the hypothesis that transforming doctrine and tactics can yield significant benefits on the Information Age battlefield. Each scenario was followed by detailed after action reviews, which were designed to capture the lessons of the experiment for both digital doctrine writers, and for subsequent field trials with actual digitized systems. Further experimentation is necessary with actual forces in the field to refine and test the observations provided by constructive simulation, but several conclusions appear to have enduring value for digitized operations.

New Paradigms for the Digitized Battlefield

Fires, as opposed to forces, will dominate the Information Age battlefield. Historical analogy must return to the advent of the Minie ball to find a technical military revolution with comparable implications for warfighting. Current formations and tactics, driven as they are by the principle of mass as the central focus of tactical success, will soon be obsolete. Like Napoleonic columns,

squares and cavalry charges confronting the enhanced lethality of the Minie ball, massed armor and infantry forces in the future will confront a veritible hurricane of concentrated and devastatingly accurate indirect and PGM fires. Increased lethality of future weapons systems will render current tactics of massing forces to mass fires hideously expensive, if not downright suicidal. The new focus and primary role of our direct combat forces (infantry, armor, cavalry) will be to provide real-time, sensor-to-shooter links, replacing their traditional role of providing direct fires. Freed from the necessity of massing direct fire systems to mass direct fires, smaller and more agile tactical formations will be able to use dispersion, stealth and mobility to survive on a vastly more dangerous battlefield. These small, agile forces will be able to operate over a much wider area, and with much greater effectiveness than their non-digitized predecessors. Greater dispersion will make digitized forces more survivable in the face of the enhanced lethality of future weapons systems. Greater effectiveness will allow these dispersed forces to retain their ability to dominate the maneuver fight. .

Internetted, non-hierarchical command and staff processes can supplement more traditional, hierarchically organized command structures to exploit enhanced situational awareness and automated C4I processes. New organizations and processes must be developed to augment existing structures and systems. The free and open exchange of information along horizontally and vertically networked C4I structures will become the engine of the RMA, facilitating exponential increases in optempo and lethality.

Riding the Tiger

Force XXI, the U.S. Army's answer to the challenges of the RMA, should embrace distributed operations on a nonlinear battlefield. Concentrated fires should replace mass in Force XXI doctrine as the fundamental enabler of

battlefield success. Effective, real-time sensor-to-shooter links should be developed to translate fire concentrations into lethal effects. Information Age battle command must exploit what General John Cushman has described as the "Living Joint Force Internet" to transform C4I, optimizing it for the digitized battlefield.[21]

Successful transformation of our warfighting "system of systems" will support our stated national military objective of achieving decisive victory while minimizing battlefield losses. Such a transformation can provide the key to confronting rising threats world-wide in an era where declining resources are dictating a progressively smaller force structure across all components of our armed forces. In contrast, the failure to embrace fundamental change risks defeat by relatively small military institutions which have successfully assimilated the lessons of the RMA, and have invested in the appropriate enabling technologies.

Endnotes

[1]"Longbow Hellfire Test Firing Results," Unpublished Briefing, U.S. Army Aviation Center, Fort Rucker, Alabama, 1995.

[2]"Analysis of Results," Advanced Warfighting Experiment Focused Dispatch: Final Report (Draft) (Fort Monroe: U. S. Army Training and Doctrine Command, 1996) 19, 30.

[3]Joint Vision 2010 (Draft) (Washington, D.C.: Office of the Joint Chiefs of Staff, 1996) 4.

[4]Scott R. Gourley, "Fighting with Fires: US Artillery Modernisation," Military Technology 18, no. 12 (1994): 10.

[5]Association of the United States Army, Ed., Army Green Book 1995-96 45, no. 10 (1995): 64.

[6]Advanced Warfighting Working Group, Ed., Capability Workbook (Volume 1) (Fort Knox: U.S.Army Armor Center, 1994) 61-63.

[7]Leo J. Baxter, "Field Artillery Vision 2020," Field Artillery, December, 1994, 13.

[8]Ibid., 12-13.

[9]Robert B. Mitchell, "Longbow Lifts the Fog of War," unpublished briefing (Fort Rucker: TRADOC System Manager for Longbow, 1994).

[10]Observed by the author during the fighting around FOB Cobra, Iraq, 24 February/ 1991. See Thomas A. Dempsey, "On the Wings of the Storm: Heliborne Maneuver during the Gulf War," Defense Analysis 10, no. 2 (1994): 170.

[11]Gregory J. Dyekman, "The 21st Century Land Warrior," Infantry 84, no. 4 (1994): 12-14.

[12]Mitchell, "Longbow Lifts the Fog of War."

[13]ST 71-3, Tactics, Techniques and Procedures for the Digitized Brigade (Fort Knox: USAARMC, 1995) 2-8, 2-9.

[14]Prairie Warrior '95 Initial Impressions Report (Fort Leavenworth: Joint Venture Combined Arms Assessment Team, 1995) 2-2.

[15]Ibid., ES-2.

[16]Joint Vision 2010, 4.

[17]J. F. C. Fuller, Sir John Moore's System of Training (London: Hutchinson & Co., 1925), 223.

[18]TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Twenty-First Century (Fort Monroe: U.S. Army Training and Doctrine Command, August 1994).

[19]Thomas A. Dempsey, "2nd Battalion, 46th Infantry Janus Exercise," unpublished briefing delivered to the Advanced Warfighting Working Group Warfighting Seminar, U.S. Army Armor Center, Fort Knox, Kentucky, 1994.

[20]A Videocassette summarizing the capstone Advanced Warfighting Exercise is available from the U.S. Army Armor Center under the title Virtual Kyrgyzstan III: Operation Ayn Dar, 16 min. (Fort Knox: U.S. Army Armor Center, 1995), videocassette.

[21]John H. Cushman, Thoughts for Joint Commanders (Annapolis: Whitmore Printing, 1993), 42-44.

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